Chapter 6.1 STATE BACKGROUND INFORMATION

Population

The Commonwealth of Virginia covers 40,741 square miles, ranking 36th among the states in size. This area is divided into seven Department of Environmental Quality (DEQ) regional offices with two satellite offices. According to the most recent census (2000), the population of the Commonwealth was estimated to be 7,078,515, 2.5% of the total United States population. It has grown 14.4% between 1990 and 2000, ranking 12th nationally, and continues to grow. Approximately 72% of all Virginians live in eight metropolitan areas: Northern Virginia, Norfolk-Virginia Beach-Newport News, Richmond-Petersburg, Roanoke, Lynchburg, Charlottesville, Danville, Johnson City-Kingsport-Bristol. Approximately 9% of the population live in seven smaller urban areas and 19% live in rural areas.

Geography

Virginia is over 400 miles wide along its southern boundary, reaching from the Atlantic Ocean in the east, crossing the eastern continental divide into the Mississippi Basin to the west. Along the way, Virginia crosses five physiographic provinces. The southwestern edge of the state touches upon the margin of the Cumberland Plateau, rugged terrain with formations of sandstone and shale. Virginia's coal mining industry is concentrated in this area. The Valley and Ridge province encompasses the long, parallel ridges of the Appalachian Mountain chain in western Virginia. Erosion resistant quartzites and sandstones form the ridgetops, while streams have carved valleys into the softer limestones and shales. The narrow Blue Ridge Mountain province is made up of hard greenstone, quartzites, and granites, igneous and metamorphic rocks that originated as ancient lava flows. These mountains are among the oldest on earth. East of the Blue Ridge Mountains lies the rolling Piedmont of central Virginia. A complex layer of igneous and metamorphic rocks underlies this area. The Triassic Basins, ancient down-faulted basins filled with sedimentary rocks and igneous intrusions are major sub-units of this province. A distinctive fall line, marked by waterfalls and rapids across the major rivers, divides the Piedmont from the Coastal Plain. Virginia's flat Tidewater area consists of deep, unconsolidated deposits of sand, gravel, fossil shells, and clay. The basement formation of granite, exposed at the fall line, is buried under 2,900 feet of sediment at the Atlantic Coast.

Water Resources

A summary of Virginia's water resources is provided in Table 6.1-1. Virginia has an estimated 50,537 miles of streams and rivers divided into nine major basins. This estimate represents mileage determined by EPA's National Hydrography Dataset (NHD). Annual rainfall averages almost 43 inches. Total combined flow of all freshwater streams in the state is estimated at about 25 billion gallons per day. The 248 publicly owned lakes in the Commonwealth have a combined area of 162,230 acres. Three large impoundments (Lakes Gaston, Kerr, and Smith Mountain) account for two-thirds of this total. Many thousands of other smaller, privately held lakes, reservoirs and ponds, some of significant size, dot the landscape.

Other significant water features of Virginia include approximately 236,900 acres of tidal and coastal wetlands, 808,000 acres of freshwater wetlands, 120 miles of Atlantic Ocean coastline, and over 2,500 square miles of estuaries. Virginia's highly indented shoreline, including the Chesapeake Bay and its sub-estuaries, is conservatively estimated to be 3,315 miles long.

Table 6.1 - 1 Virginia Water Resources Atlas

State Population (2000 census) – 7,078,515

State Surface Area – 40,741 square miles

Major River Basins

Potomac/Shenandoah	Tennessee/Big Sandy
James	Chesapeake Bay/Small Coastal
York	Rappahannock
Roanoke	New
Chowan/Dismal Swamp	

Perennial River Miles	50,537
Total Non-Tidal Stream Miles	50,537

Miles of Border River (Potomac) – 180

Publicly-Owned Lakes and Reservoirs	Number	Acres
Greater than 5,000 acres	5	106,440
Less than 5,000 acres	243	52,392
Total	248	162,230

Acres of Freshwater Wetlands - 808,000

Acres of Tidal and Coastal Wetlands - 236,900

Estuary Square Miles - 2,500

Atlantic Ocean Coastal Miles – 120

Total Coastal Shoreline Miles,
Including Chesapeake Bay and Tidal
Tributaries to a Width of 110 Feet - 3,315

Statewide Average Annual Rainfall - 42.8 inches

Average Freshwater
Discharge of All Rivers – Approximately 25 billion gallons per day

Land Use

Virginia's landscape is dominated by forests, which cover approximately 55.6% of its total area (Table 6.1-2). However, according to the Virginia Department of Forestry, a loss of commercial forest and cropland has contributed to an increase in urban land from 10.4% to 14.8% from 1991 to 1995.

The second most prevalent land use in Virginia is agriculture, covering 25.9% of the State's total land area. Cropland accounts for 2,903 square miles, about 7.1 percent of the State's total area while pasture and hay production account for 6,845.3 square miles, or about 16.8% of the State's land. The remaining 6,029 square miles of land area, approximately 14.8%, includes urban areas. Inland waters account for the remaining 3.7%.

Table 6.1-2 Virginia Statewide Land Use Summary

Commercial Forest	20,058.6 mi^2	49.2%
National Forests	2,550.0 mi^2	6.4%
Total Forested Land	**22,608.6 mi^2**	**55.6%**
Cropland	2,903.4 mi^2	7.1%
Pasture/Hay	6,845.3 mi^2	16.8%
Other	828.1 mi^2	2.0%
Total Agricultural Land	**10,576.8 mi^2**	**25.9%**
Other (Including Urban)	**6,029.1 mi^2**	**14.8%**
Total Land Area	39,214.5 mi^2	96.3%
Inland Waters	1,526.4 mi^2	3.7%
Total Area	**40,740.9 mi^2**	**100.0%**

<u>Overall Water Quality Trends</u>

The following information are the quoted conclusions about long-term water quality trends in Virginia, based on the 1998 Special Report produced by the Water Resources Research Center and Virginia Polytechnic Institute and State University better known as Virginia Tech. **A copy of the full report can be requested at HTTP://WWW.VWRRC.VT.EDU/PUBLICATIONS/sr11-98.pdf.**

On a statewide basis, significant and apparent trends indicating water quality improvement outnumbered trends indicating water quality deterioration for biological organic demand (BOD), total phosphorus (TP), fecal coliform (FC), non filterable residue (NFR = suspended solids) and dissolved oxygen (DO). For BOD, NFR and TP, trends representing water quality improvement outnumbered trends representing water quality deterioration by ratios exceeding 3:1. For BOD, declining trends representing water quality improvement were predominant statewide.

For both nitrate-nitrite nitrogen (NN) and Total Kjeldahl Nitrogen (TKN), increasing trends outnumbered declining trends; increasing levels of nitrogen are generally interpreted to indicate deteriorating water quality. On a statewide basis, there is a tendency for increasing NN trends to occur at stations with relatively high medians.

Declining pH trends outnumbered increasing pH trends by a slight margin. Excluding coalfield stations (where acid mine-drainage treatment may be responsible for the predominance of increasing pH trends), declining pH trends outnumbered increasing trends by a margin of nearly 2 to 1. Increasing total residue (TR) trends and decreasing TR trends occurred in approximately equal numbers.

A number of regional patterns were observed, including the following:

- Relatively high DO and pH medians tend to occur in western Virginia, and relatively low DO and pH medians tend to occur in eastern Virginia. Relatively high TR and NFR medians tend to occur in eastern areas.
- Declining pH trends were prevalent in the *Holston* basin and in eastern Virginia close to the Chesapeake Bay
- Increasing pH and TR trends were prevalent in coalfield areas (the *Big Sandy* basin and the Upper *Powell*); coalfield areas also exhibited relatively high pH and TR medians.
- Declining NFR trends were prevalent in western Virginia's *Big Sandy*, *Clinch-Powell*, and *Holston*

basins, as well as the upper *Potomac* and *Shenandoah* basins, and throughout the *James* basin.

- Increasing NN trends are prevalent in northwestern Virginia, including the *Shenandoah*, upper *Potomac*, and upper *Rappahannock* basins, while increasing TKN trends are prevalent in eastern Virginia. Both increasing NN and TKN trends are prevalent in the *Holston* and upper *Rappahannock* basins.

- Relatively high NN medians tend to occur in western Virginia, while relatively low NN medians tend to occur in the eastern part of the state. This pattern is reversed for TKN medians.

- Throughout the state, there is a tendency for increasing NN trends to occur at stations with relatively high medians. In other words, the analysis revealed a tendency for NN concentrations to increase at locations where median NN levels are relatively high.

- Declining TP trends were prevalent in the southwestern Virginia's *Big Sandy* and *Clinch-Powe*ll basins, and along the South Fork of the Shenandoah in the *Shenandoah* basin. Eight of the state's 13 significantly increasing TP trends were located in eastern Virginia.

- Declining FC trends were prevalent in the southwestern Virginia's *Big Sandy*, *Clinch-Powell*, and *Holston* basins, and in the upper *New* River basin. Most of the southwestern Virginia stations exhibiting significant or apparent declining FC trends were also characterized by relatively high FC medians.

Several methodological issues are also present. The best estimate of slope was found to be zero for numerous variables and stations exhibiting significant or apparent BOD, NFR, TKN, TP, and FC trends, indicating that a key factor in trend detection was a changing incidence of relatively high values for these variables. Flow data and information on the precision of analytical measurements were unavailable; therefore, these factors were not considered in conducting seasonal Kendall analysis. The seasonal Kendall's technique is capable of detecting only for monotonic trends; therefore any non-monotonic patterns of water quality change that may have been present – for example, if two segments of a data set were to exhibit differing patterns of change – would not have been detected by these analysis.

Because of uncertainties regarding the ability of the monitoring stations chosen to adequately represent statewide water quality and variations in periods of data coverage, decreasing trends cannot be interpreted as a direct representation of general statewide change in water quality. However, study results do provide evidence of potential long-term water quality improvement with respect to DO, BOD, NFR, TP, and FC, while results for both nitrogen variables (NN and TKN) provide evidence for potential water quality deterioration with respect to N.

DEQ has recently received new and updated trend analysis software, which will be used in future, trend analysis work. It is anticipated that a whole section on trends in Virginia will be included in the next 2006 Integrated Report.